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The Development of an Integrated E-Module of Scientific Literacy and Video Demonstration Using a Problem-Based Learning Model for High School Students on Acids and Bases

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Abstract: This study aims to develop e-module teaching materials based on problem-based learning integrated scientific literacy and demonstration videos on acid and base materials that are useful for assisting the learning process of students. This research belongs to Educational Design Research (EDR) with the Plomp development model. The research tools used are interview forms, validity, and practicality questionnaires. The electronic module is verified by six verifiers, Including three lecturers and chemistry teachers. The data shows that problem-based learning e-module teaching materials and equipped with scientific literacy along with demonstration videos are needed. The data were analyzed using the Content Validity Ratio (CVR), the Aikens'V formula, and the percentage of practicality. Analysis of the validity questionnaire data showed an average CVR score of 1 (for content validity) and Aikens' V average score of 0.88 (for construct validity). Analysis of the practicality questionnaire data showed an average score of 90% and 89% (for small group and field test practicalities). The data analysis shows that the e-module has a high level of validity and practicality. Therefore, it can be concluded that the developed electronic module teaching materials based on problem learning integrated scientific literacy and demonstration videos are valid and practical.

Keywords: Acids and bases; Demonstration videos; E-module; Scientific literacy; Problem-Based Learning

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Introduction

In the current era of the industrial revolution (4.0), one that affects the world of education is the rapid development of technology. Technology is a means that can advance the world of education and support successful learning (Lestari, 2018). Integrating technology into the learning process can improve learning, develop students' abilities, and be used as a solution to educational problems that will provide benefits for improving the quality (Darimi, 2017; Komalasari, 2020).

The rapid development of information technology helps teachers to be more innovative in developing teaching materials. One form of teaching materials is e-module. Electronic modules are textbooks in the form of modules, which can be displayed in electronic form and used as independent learning materials to be systematically arranged to increase students' interest and enthusiasm for learning (Direktorat, 2017).

The development of electronic modules can be combined with learning models that can support student learning activities. Problem-based learning is a learning model that presents problems and students are expected to be able to develop their understanding

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through problems in life and provide solutions to these problems (Saputro et al., 2020; Serevina, 2018). Learning is carried out through collaborative group work and effective communication and leadership skills (Ayyildiz & Tarhan, 2018). During problem-based learning, students are asked to follow a series of procedures in solving problems of everyday life (Tosun & Taskesenligil, 2013). The problem-based learning model can improve academic achievement and skills related to the cognitive and affective domains, can improve metacognition skills, and have a positive effect on improving problem-solving skills in chemical concepts (Baran & Sozbilir, 2018; Ramdoniati et al., 2018; Valdez & Bungihan, 2019). The results of research conducted by (Barth et al., 2019), explain that problem-based learning is effectively used in training programs adapted to pre-service teachers through teaching elements.

Problem-based learning-based e-modules provide innovative learning resources for students so that learning becomes effective, interesting, makes students learn active, and can improve students' critical thinking skills (Jaenudin et al., 2017; Prabasari et al., 2021). The problem-based learning model is also an alternative that is quite effective in building scientific literacy in the 21st century. In problem-based learning, problems can be used as a stimulus and focus for student learning activities, so that problem-based learning models can be combined with scientific literacy.

Science literacy is one of the keys to meeting the challenges of the 21st century and is one aspect of the PISA assessment (program for international student assessment). Scientific literacy is needed to strengthen students' knowledge (Budiman et al., 2021). Obtaining PISA 2018 results, Indonesia is in position 72 out of 77 countries (OECD, n.d, 2019). Research conducted by research and development institutions, one of the factors that influence low literacy is teaching materials (Fuadi et al., 2020). Teaching materials in the form of electronic modules based on problem-based learning and comprehensive scientific literacy are needed (Kemendikbud, 2020). This strategy can be applied in learning Natural Sciences, especially chemistry. One of the chemical materials studied in school is acids and bases. Acid-base materials are one of the difficult materials for students (Artdej et al., 2010, p.180). This material contains the dimensions of factual knowledge, concepts, principles, and procedures. In the study of acid-base, students not only learn concepts, memorize and introduce formulas, but also have direct experience through the experimental process.

The results of interviews that have been conducted with chemistry teachers and students in several public high schools in the city of Padang show that in the learning process the teacher uses the lecture and discussion method. The textbooks used by teachers are in the form of printed textbooks and do not contain scientific literacy. While the teaching materials that are preferred by students are teaching materials that are equipped with videos, animations, and pictures involving smartphones/laptops. This is based on the requirements of the 2013 curriculum. It is hoped that students will be able to proficiently use the media, technology, information, and communications (ICT) required in the 21st century. The practical acid and base material has not been implemented yet, due to several factors including; the lack of labor facilities, time for practicum, and the Covid-19 pandemic that requires students to study at home through online learning (Kemendikbud, 2020b).

Distance learning in the form of practicum for the field of chemistry is very difficult to implement, especially in achieving practical expertise competence (Frima, 2020). These problems can be overcome by making practical demonstration videos by the teacher. The use of practicum videos is effectively used as teaching material that can guide practicum, increase motivation and learning outcomes, improve problem-solving skills, and can increase students' positive behavior (Frima, 2020; Prabasari et al., 2021; Rahmana et al., 2021; Rahmia, 2014). In some studies, the use of problem-based learning-based teaching materials in the form of electronic modules can improve learning outcomes and improve students' critical and creative thinking skills (Kusumaningtyas et al., 2019; Pramana et al., 2020). The research results show that the use of electronic modules is effective and practical in learning, especially in acid-base materials. Besides that, making IT-based learning media for chemistry teachers is effectively used in the learning process (Ernica & Hardeli, 2019; Hardeli, 2021).

Based on the description above, an e-module based on problem-based learning integrated scientific literacy and video demonstrations on acid and base materials for class XI SMA/MA students was developed".

Method

Educational Design Research (EDR) is the type of research used in this study. The Plomp model is the development model used in this study. The research phase of the Plomp model includes preliminary research, prototype design phase, and evaluation phase (Plomp & Nieveen, 2013). The subjects in this development research consist of three lecturers, three chemistry teachers, and students in the XI IPA SMA/MA class.

The making of teaching materials begins with the preliminary research stage, which is carried out through needs analysis, context analysis, literature review, and the development of a conceptual framework. The prototyping stage is carried out through product design, which produces four prototypes. For each prototype produced, formative evaluation and revision of the prototype are carried out. The formative evaluation carried out was based on the formative evaluation proposed by Tessmer, namely self-evaluation for prototype I, one-to-one evaluation and expert review for prototype II, small group evaluation for prototype III, and field tests for prototype IV (Plomp & Nieveen, 2013). The assessment stage is the stage in which the product is semi-summative evaluated through field tests. This research has only been carried out to the stage of validity and practicality by producing a valid and practical electronics module.

The developed acid-base electronic module was verified by six verifiers, including three lecturers and three teachers. The instruments used were interview sheets, validation questionnaires (in the form of content validation and construct validation), practicality questionnaires. The type of data obtained from this research is in the form of quantitative data and qualitative data. Quantitative data was obtained from the results of filling out a validation and practicality questionnaire, while qualitative data was obtained from suggestions from the validator. The validity of the developed e-module is obtained through the data from the assessment results provided by the validator on the content validation and construct validation sheets. The data that has been obtained from the content and construct validation questionnaire will be analyzed using CVR and Aiken's V. Practical data is analyzed using the percentage of practicality.

The content validity analysis technique used is CVR or Content Validity Ratio and Content Validity Index developed by Lawshe (Lawshe, 1975). This technique is a method for measuring agreement among raters regarding the importance of certain items. After identification of the validation sheet using the CVR, the Content Validity Index (CVI) can be calculated. The CVI is the average of the CVR values of the items that answered "yes". The analysis technique using CVR can be seen in equation 1.

$$CVR = \frac{(n - \frac{N}{2})}{\frac{N}{2}} \quad \ldots\ldots (1)$$

Description:
CVR = content validity ratio
n = number of experts who answered valid
N = total number of experts
Where,

$$CVI = \frac{\text{Number of CVRs received}}{\text{Number of accepted aspects}}$$

The e-module validity decision determined by CVR is adjusted to a critical value according to the number of validators, see Table 1 (Wilson et al., 2012).

Table 1. Critical Value of CVR

Number of Validators	Critical Value of CVR
5	0.736
6	0.672
7	0.622
8	0.582

Meanwhile, for construct validity using the Aikens'V formula. The construct validation questionnaire contains four aspects consisting of aspects of content component assessment, linguistic component, presentation component, and graphic component (Aiken, 1980). The analysis technique using Aikens'V can be seen in equation 2.

$$V = \sum \frac{s}{n(c-1)} \quad \ldots\ldots (2)$$

Description:

$s = r - I_0$

Io = low validity score
C = the highest validity rating score
r = number given by an evaluator
n = number of validators (appraisers)

The e-module validity decision determined by Aikens'V is adjusted to a critical value according to the number of validators, the error level is 5%, and the Likert scale is 5, see Table 2 (Aiken, 1980).

Table 2. Aiken's V Critical Value

Number of Validators	Critical Value of Aiken's V
5	0.80
6	0.79
7	0.75
8	0.75

Data from the practicality questionnaire will be analyzed using equation 3.

$$\text{Practical value} = \frac{\text{total score obtained}}{\text{maximum score}} x100\% \quad \ldots (3)$$

The decision on the practicality of the e-module determined by using the practicality percentage is adjusted to the critical value based on the practicality value obtained, which can be seen in Table 3 (Purwanto, 2012).

Table 3. Practical Products Category

Interval	**Category**
0-20	Not practical
21-40	Less practical
41-60	Quite practical
61-80	Practical
81-100	Very practical

Result and Discussion

This study aims to see the validity and practicality of problem-based e-modules for integrated science literacy learning and video demos of acid-base materials for class XI SMA/MA. This research adopts the Plomp development model, including the preliminary research phase, prototype phase, and assessment phase.

Preliminary Research

The making of teaching materials begins with the preliminary research stage, which is carried out through needs analysis, context analysis, literature, and the development of a conceptual framework. In the needs analysis stage, the data obtained in the field showed that in the process of learning chemistry on acid and base materials the teacher used lecture and discussion methods. Teachers have not implemented literacy strategies in learning, even in teaching materials. One of the factors that influence students' lack of scientific literacy is teaching materials (Fuadi et al., 2020). Practicum cannot be carried out due to the Covid-19 pandemic. The existence of reading sources regarding acid and base practicum does not help students in understanding the material because students do not see directly the process of implementing the practicum. The textbooks used are in the form of printed textbooks, including pictures, texts, and evaluation questions, which do not generate students' interest and enthusiasm in the learning process. Meanwhile, students like teaching materials that are equipped with pictures, videos, and animations with their application using a laptop or cellphone.

Based on the results of the needs analysis, it was also found that in the 2013 curriculum the learning pattern was student center. In addition, the 2013 curriculum also expects students to be skilled in utilizing technology in learning (Permendikbud, 2013). The presence of the COVID-19 pandemic is affecting every aspect of life, especially education, prompting the government to release a study at home. The application of home learning policies in the 4.0 era of the Industrial Revolution also requires electronic learning equipment such as electronic modules. Electronic modules can support independent learning and improve student learning outcomes. The use of electronic modules in learning is based on the application of problem-based learning models to guide students to find and form their learning concepts and meanings. Based on this analysis, a textbook in the form of an electronic module based on problem-based learning and comprehensive scientific literacy and demonstration videos on acid and base materials are developed which can be appropriate and become an alternative to meet the demands of the 2013 curriculum.

In the context analysis stage, curriculum analysis and syllabus analysis were carried out in the 2013 curriculum. Based on the curriculum analysis, it was found that the 2013 curriculum requires students to actively seek, process, and develop knowledge in the learning process and is skilled at using media and technology (Permendikbud, 2013). This can be achieved by applying problem-based learning versions and using teaching materials in the form of electronic modules when implementing learning. analysis of the syllabus inside the 2013 curriculum that has been accomplished is inside the shape of an analysis of basic competencies from acid and base fabric that's translated into indicators of competency achievement and studying goals. Basic Competence (KD) in this material is KD 3.10 which is translated into Competency Achievement Indicators 3.10.1, 3.10.2, 3.10.3, 3.10.4, and 3.10.5. From the Competency Achievement Indicators, learning objectives will be obtained. Based on the Competency Achievement Indicators, the core material that will be described or described in the e-module can be determined.

The literature research step aims to find and understand sources of documents and references related to research activities. Sources and references can be in the form of books, magazines, or Internet sources. From this activity obtained; the components in the e-module are compiled based on the guidelines for the preparation of the e-module based on the 2017 Ministry of Education and Culture; the material contained in the e-module is taken from university sources and high school chemistry books that are adjusted to a predetermined Competency Achievement Indicators; problem-based learning models are referenced from relevant articles; The scientific literacy graphic design was compiled based on the 2020 Ministry of Education and Culture's scientific literacy graphic preparation guidelines.

The concept analysis stage aims to determine the basic things needed for acids and bases by determining the main concepts contained in acids and bases and compiled into a hierarchical concept map based on the sourcebook, using a textbook. Based on the conceptual analysis performed, the results show that the main concepts that students must master are: formulating the concept of acids and bases, indicators of acids and bases, determining the pH of acids and bases. The results of the conceptual analysis are described in the form of a conceptual analysis table.

Prototype Stage

The second stage in the Plomp development model is the prototyping stage. At this stage, the design was carried out to develop an acid-base e-module based on integrated scientific literacy problem-based learning and acid-base demonstration videos to improve learning outcomes. This stage produces four prototypes where each prototype is evaluated formatively. This research is only limited to the stage of product validation and practical.

The first stage is prototype I, namely the prototype produced from the design and realization of preliminary research. The resulting prototype is an acid-base e-module based on integrated scientific literacy problem-based learning and a demonstration video that follows the e-module components contained in the e-module preparation practicum guide. The form of the e-module cover display can be seen in Figure 1.

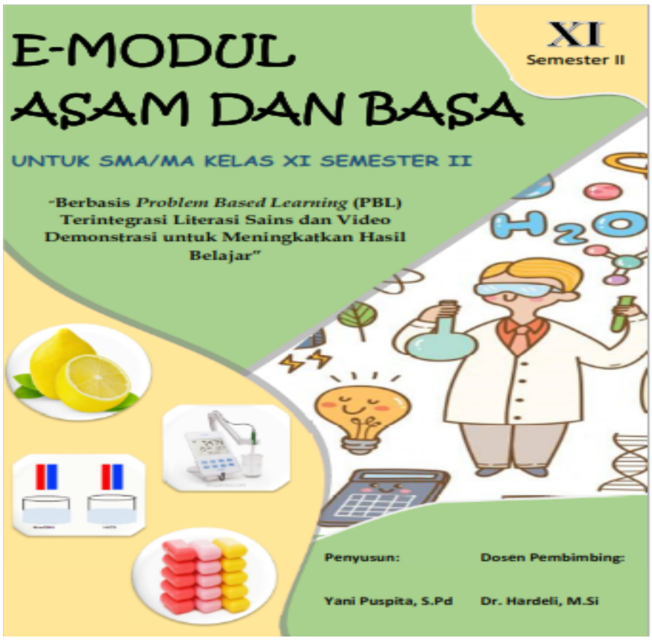

Figure 1. E-module cover design

The e-module design is also prepared based on problem-based learning steps. The e-module created also integrates scientific literacy in it by using a scientific literacy graphic controller which has an important role in helping students map their understanding process of reading/information (Kemendikbud, 2020b). The form of the scientific literacy graphic design can be seen in Figure 2.

This e-module is also equipped with a practical demonstration video made by the teacher using the movie maker application. Videos can present information, explain processes, remember information, explain complex concepts, teach skills, shorten the time, and help to understand (Azhar, 2011). The presence of practical demonstration videos can improve students' basic scientific process skills, i.e. all aspects of observing, classifying, measuring, inferring, predicting, and communicating (Arrohman, 2021). The form of the demonstration video application can be seen in Figure 3.

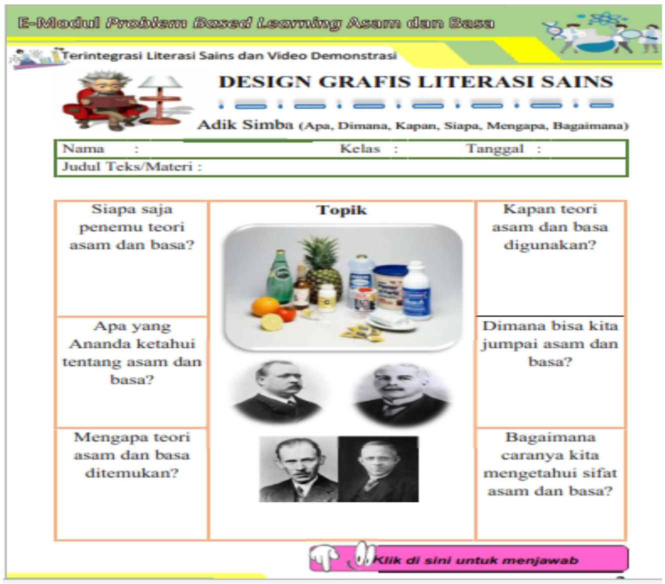

Figure 2. Scientific literacy graphic design

Figure 3. Application of demonstration videos on e-modules

The design of prototype I in the form of an acid and base e-module is primarily based on problem-based studying using the flipbook maker pro software. The type of writing used varies with the size that is adjusted. The choice of color variations for prototype I was adjusted to the needs to make it look attractive, which was dominated by green and yellow. E-modules that have been developed can be presented using a laptop or smartphone.

Prototype II is generated after performing a formality assessment in the form of the Prototype I self-evaluation. This self-evaluation focuses on any discrepancies that arise such as inconsistencies in letter input, image usage, module completeness as to what should be in a module, and completeness of steps problem-based learning model. Learning model problem-based learning Based on the results of self-evaluation, it was found that prototype I needed to be revised. Revisions were made to prototype I in the form of adding an e-module component, namely adding a scoring guide component to the e-module.

Prototype III was produced after formative evaluation and revision of prototype II was carried out. The formative evaluation is carried out in the form of personal assessment and expert review. The individual assessment was conducted by interviewing three students from Grade XI with low, medium, and high abilities. Three aspects are assessed at this stage, namely clarity, attractiveness, and visible flaws.

Based on the results of the interviews conducted, it is found that the e-module created is clear and understandable for the students, then for the appeal as an e-module cover display, it was very appealing and characterized the e-module identity as it contained images related to acid-base materials. The existence of an attractively designed e-module will increase students' motivation in reading learning materials (Perdana et al., 2017). Errors that appear in the e-module are also not found by students. The use of videos and pictures in the e-module makes students interested in learning this e-module. This is following previous research (Rendra et al., 2018) which states that students are happier with learning accompanied by videos because it will make students interested in learning the material provided. The e-module user manual is also easy to understand, the presentation of the material in the e-module is also clear, and the language used in the e-module is also easy to understand. And the learning steps are easy to understand for students. This follows the criteria of the teaching material, where the teaching material must be systematically and attractively designed to achieve the desired goals, namely the acquisition of competence or competence sub in all its complexity (Magdalena et al., 2020).

At the time of filling out the one-to-one evaluation e-module, students with low abilities initially had difficulty formulating the hypotheses presented in the e-module. This is because they are not used to formulating problems. In addition, students with low abilities have difficulty in answering practice questions.

The expert review was carried out by six validators, three lecturers, and three chemistry teachers. There are two types of validity tests, namely content validity and construct validity. The e-module content validation questionnaire contains two assessment dimensions, that of the e-module suitability to the problem-based learning syntax (an aspect I) and the accuracy aspect of the e-module content to chemical scientific content (an aspect II). Each aspect was assessed in a content validation questionnaire consisting of 25 questions. The validator's assessment of the validity of the e-module content was analyzed using CVR and CVI methods.

Based on the CVR value from the results of content validity data processing for aspects of e-module suitability with problem-based learning syntax (aspect I) and aspects of the correctness of e-module content on chemical scientific content (aspect II), it was found that each statement item in the validation questionnaire was accepted by the validator. The acceptance of each statement item in the validation questionnaire is because the CVR value of each item is greater than the critical value of 0.672 for 6 panelists. After the CVR value of each statement item in both aspects is obtained, then the CVI value or average CVR can be calculated. The results of content validity data processing can be seen in Table 4.

Table 4. The results of the validity of the acid and base e-module content by the validator

Aspect Assessed	Average CVR	Validity
Aspect I	1	Valid
Aspect II	1	Valid
Average	1	Valid

Based on the information in Table 1, it can be seen that all aspects assessed are valid. This shows that each statement item in the developed e-module is following the problem-based learning syntax and following the content of chemistry. Content validity does not reveal the level of product validity, but only reveals the validity or invalidity of a product. However, it can be seen that if the CVR value is closer to 0.99, the content validation will be higher (Allahyari et al., 2010). Thus, the developed acid and base e-module is valid and can be tested.

The next validity test is constructed validity. The construct validation questionnaire contains four aspects consisting of aspects of assessing content components, linguistic components, presentation components, and graphic components (Muljono, 2007). The results of data processing the validity construct of the acid and bases e-module getting to know can be seen in Table 5.

Table 5. The results of the validity of the acid and base e-module constructs by the validator

Aspect Assessed	V	Validity Category
Content component	0.90	Valid
Language component	0.87	Valid
Presentation component	0.88	Valid
Graphics component	0.87	Valid
Average construct validity	0.88	Valid

Description V = Aiken's V Index

An assessment of the component aspects of the acid and base e-module contents is related to the e-module arrangement. The results of the validation based on the information in Table 4 obtained Aiken's construct validity value of 0.90. Therefore, the valid range of content elements contained in the e-module is very high. Based on the Aiken value of V obtained, this indicates that the acid and base e-module developed conforms to the Basic Competency (KD) requirements, namely KD 3.10 and KD 4.10 contained in the 2013 curriculum syllabus, as well as the learning objectives achieved and the materials provided that are appropriate to the student's abilities. The resulting e-module contains compatibility between the questions given and the material being studied. Display animations, practicum videos, and pictures provide information and help students understand acid and base material. This is following that a good e-module is equipped with the presentation of video tutorials, animations, and audio to enrich the student learning experience (Kemendikbud, 2017).

The assessment of language components refers to the language used to the acid-base material in e-module. According to the information in Table 4. Based on the information in Table 4, the Aikens value for the linguistic component is 0.87. Thus, the category of validity of the linguistic components used in the e-module is valid. According to the obtained values, it shows that the developed acid-base e-module is used well, and the Indonesian language is concise and easy to understand for the users of the e-module. A good e-module should have criteria for using simple, easy-to-understand language and put forward general terms so that it is user-friendly (Kemendikbud, 2017). The use of communicative language can affect students' interest in learning (Sulistiani, 2014). A good teaching material assesses the components it contains, namely legibility, clarity of information, compliance with good and correct Indonesian language rules, and use of clear and understandable language (Depdiknas, 2008).

Assessment of the presentation component aspects of the acid and base chemistry e-module based on Table 3, the average value of Aikens'V was 0.88. Thus, the category of presentation validity in the e-module is valid. This shows that the acid and base e-module developed has been systematically arranged according to the e-module components (Direktorat, 2017). In addition, the e-modules made are following the abilities of high school students, the learning syntax contained in the e-modules is also following the problem-based learning syntax, namely student orientation in solving problems, managing student learning, directing individuals/groups, presenting and developing work, as well as analyzing and developing problem-solving processes (Hosnan, 2014). At each of these stages, various components can attract students' attention such as pictures, videos, and animations as well as supporting materials that are presented so that students can understand the material and draw conclusions from what they have learned. The questions presented in the e-module have been compiled based on indicators and learning objectives. In addition, students can also measure the extent to which students understand the material through feedback on questions on worksheets and evaluation sheets. Questions in each stage of the problem-based learning model that were made were able to direct students in achieving indicators of competency achievement.

Assessment of the aspects of the graphic component related to the proportion of the overall e-module design such as layouts, logos, symbols, and illustrations must be suitable and attractive. Based on the information in Table 3, the Aikens value of 0.87 is obtained, so the validity category is valid. This shows that the design of the developed modules is suitable and attractive, to increase the interest of students in reading and understanding the learning materials presented (Perdana et al., 2017). And the use of pictures can add to the attractiveness of teaching materials and can reduce student boredom in learning them (Kuswanto & Kunci, 2019). The use of consistent type and size of letters can also affect the comfort of students in using e-modules. The attractiveness of students to e-modules will also appear if the layout and design used is attractive accompanied by audio and animation elements, this will also increase the motivation, interest, and creativity of students (Ramadhani & Ketut Mahardika, 2015).

Aspects that were assessed as a whole for the problem-based learning-based e-module construct validity test on acids and bases were valid with an average Aikens'v obtained from the six validators, which was 0.88. Valid criteria or not can be seen in the Aikens table, where the resulting V must be higher than the Vtable. The value of V is for six raters and five rating categories with an error level of 5%, which is 0.79. The value is 0.88 > 0.79 ($t_{count} > t_{table}$), the product is declared valid and can be used in the learning process.

The subsequent take a look at the stage is the formation of prototype IV with a small group take a look at. The small group take a look at changes conducted on nine students of SMAN 1 Padang. The number of students used is following the opinion of Dick that small group evaluation can be carried out on at least eight to twenty people (Walter, 2014). Sampling was based on the chemistry teacher's recommendation. Students observe and understand the material in the e-module and fill out a small group test questionnaire. The actual questionnaire test results are shown in Table 6 below.

Table 6. Practical results of small group students

Rated aspect	Practicality (%)	Practicality Category
Ease of Use	90	Very practical
Learning time efficiency	92	Very practical
Benefit	88	Very practical
Average practicality	90	Very practical

In the small group test, based on Table 6, the average percentage of practicality is 90% with a very practical category. In terms of ease of use, the average percentage of the practicality formula is 90% with a very practicality category. This proves that the problem-based learning-based acid and base e-module integrated scientific literacy and this demonstration video makes it easier for students to understand acids and bases. This is following one of the characteristics of e-modules, which is user-friendly (Kemendikbud, 2017). Ease of use is related to the clarity of the learning material, the language that is easy to understand, and the letters used that are clear and legible. This follows the principle of e-module development, i.e. e-modules are organized according to the needs and goals of language learning and communicative language (Asmiyunda, 2018).

In terms of learning time efficiency, the average percentage is 92% in the very practical category. This shows that the developed e-module allows students to learn according to their respective abilities and learning speed (Daryanto, 2016). The problem-based learning model used in the module saves time as the steps are detailed and easy to understand for students. Therefore, acid and bases based learning e-module integrated with science literacy and video demonstration can increase the efficiency of learning time. Learning using e-modules can make study time more efficient and students can learn on their own (Dwicahyono, 2014).

In terms of benefits, it has average practicality of 88% in the very practical category. This shows that this e-module is developed that can help students think critically and independently to figure out the concept of learning material. In addition, the e-module helps students deal with learning difficulties (Yerimadesi, 2018). The problem-based learning model is designed to increase student activity, be more process-oriented, and self-inform to achieve learning goals, and educators act as facilitators only support in learning activities. This is also following one of the characteristics of e-modules, namely self-contained, which means that e-modules already contain all learning materials in their entirety (Kemendikbud, 2017). Therefore, the problem-based learning-based acid and base e-module integrated scientific literacy and demonstration video is useful in learning acids and bases.

The high level of practicality of the e-module in the small group test is evidenced by the students' ability to answer the questions contained in the e-module. On each learning sheet, students' scores increase after studying the material according to the problem-based learning steps. On average, students answered correctly from each high learning sheet, which means that each learning objective was mastered by students well. So, in general, the students have mastered the acid and base material well. From the results of the small group test, in general, problem-based learning e-modules are integrated with scientific literacy and practical demonstration videos and are able to guide students in finding and understanding concepts in accordance with indicators of competency achievement and learning objectives.

Based on the description above, it can be said that the problem-based learning e-module learning materials that integrate scientifically and video literacy are valid and practical for use in learning, especially acid and base according to the results of the validity of material experts, namely content validity and construct validity. In addition to the quantity data from the results of the validation questionnaire, qualitative data was also obtained from the suggestions given by the validator. The suggestion given is to improve the undeveloped chemistry e-module. The suggestions given by the validator are improving the appearance and presentation of the e-module, adding questions contained in the syntax, replacing supporting images with more interesting ones, and following the material.

Assessment Stage

At this stage, an assessment is made to see if the resulting product can be used in practice in the field. This step of assessment is carried out using testing on high school students to see the practicality (field testing) and effectiveness of the developed e-module. However, this research only stops at the practical level. The practicality assessment will be carried out by filling out the e-module practicality instrument by students. The results of the e-module feasibility assessment for each aspect at the field testing stage are shown in Table 7.

Table 7. Practical results of field test students

Rated aspect	Practicality (%)	Practicality Category
Ease of Use	89	Very practical
Learning time efficiency	91	Very practical
Benefit	87	Very practical
Average practicality	89	Very practical

Based on table 7, it is found that in terms of ease of use with an average value of 89% with a very practical category, this proves that the problem-based learning-based acid and base e-module integrated scientific literacy and this demonstration video makes it easier for students to understand the material. acid and base. This ease of use relates to the language and material in the e-module which is clear and easy to understand because the e-module must provide text that is easy for students to understand (Laili, 2019).

In terms of learning, time efficiency has an average value of 91% with a very practical category. This suggests that the developed e-module can save time due to the stages of problem-based learning phases and can make students learn at their respective learning (Hosnan, 2014).

In terms of benefits, it is worth 87% with very practical value. This shows that the e-module has been developed that can help students independently in studying concepts from the learning material. In this case, the e-module helps the participants solve their learning difficulties (Asmiyunda, 2018). Therefore, the problem-based learning-based acid and base e-module integrated scientific literacy and demonstration video is useful in learning acids and bases.

From the results of the field test, in general, the problem-based learning-based acid and base e-module integrated scientific literacy and video demonstrations have been practical and able to guide students in finding material concepts according to learning objectives.

Conclusion

Based on the research conducted, the development of an acid-base e-module based on integrated scientific literacy learning and video demonstrations has been valid (according to the results of material expert validity, namely content validity and construct validity) and is practically used in the learning process. So that in the future, the effectiveness of the integrated problem-based learning e-module can be tested for scientific literacy and video demonstrations.

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